atherosclerosis. These include the statistical bias of studying at necropsy two potentially lethal diseases; the lowered blood pressure, increased fibrinolytic activity, and the hyperestrogenism found in cirrhotic patients; and the ability of alcohol consumption to increase high-density-lipoprotein (HDL) cholesterol levels significantly. The last is frequently cited to explain the many epidemiologic observations that show that moderate alcohol consumption itself, regardless of the presence or absence of cirrhosis, appears to be associated with a reduced mortality from coronary heart disease. That moderate alcohol consumption is protective against the development of coronary atherosclerosis is particularly intriguing in light of the known association between alcohol consumption and hypertension,[3] a known risk factor for coronary heart disease.

The protective effect of HDL cholesterol in the prevention of coronary heart disease appears to reside in a specific association with the HDL_2 subfraction.[4] Alcohol consumption, however, appears to preferentially affect the unprotective HDL_3 subfraction.[5] Further confounding this issue is the observation that the curve relating coronary heart disease mortality and alcohol use appears to be U-shaped. That is, there is substantial evidence to suggest that habitually heavy alcohol intake, in contrast to so-called moderate intake, actually results in an excess of coronary heart disease deaths.[6] The validity of this observation is supported by data showing an increase in the rate of nonfatal coronary heart disease as well in those who have a heavy alcohol consumption.[7]

It hardly makes sense today in light of the lack of understanding of the mechanisms by which moderate alcohol consumption may protect against atherogenesis to recommend its use for this purpose. Aside from the social issue of advocating the consumption of moderate amounts of a substance known to lead frequently to serious abuse, the relative risk reduction for coronary heart disease can be achieved more readily and appropriately by attention to directly eliminating the more serious risk factors such as cigarette smoking, hypertension, hypercholesterolemia, and obesity.

Alcohol abuse is the most common among the known causes of cardiomyopathy. Coronary heart disease is the leading cause of death in the industrialized world. Yet, it is clear from the above discussion that many questions remain unanswered concerning the mechanisms and association between alcohol consumption, cirrhosis, and both nonischemic and ischemic heart disease. What emerges is that despite a great number of studies in recent years involving alcohol both in animals and in humans, much further research is needed. In the interim, the one therapeutic recommendation that is readily apparent is that abstinence from alcohol is crucial to patients not only with overt cirrhosis or alcoholic cardiomyopathy, but to those who habitually ingest large amounts of alcohol even in the absence of clinical heart or liver disease.

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Perioperative Glucose Control in Diabetic Patients—Strategies for the 1990s

PERIOPERATIVE CONTROL of plasma glucose levels in diabetic patients is often a challenge. A number of factors combine to make management difficult. When patients are admitted for surgery, the physicians who will be managing their diabetes in the hospital may not have all the desirable information about the patients' treatment programs, recent levels of glucose control, existing complications, or comorbid conditions. The stress of a surgical procedure, postoperative pain, and inactivity usually causes a temporary increase in insulin requirements. Food intake is prohibited or unpredictable. Glucose is given intravenously at varying rates with maintenance fluids or medications. Even a diabetic patient on intensive management who has achieved normal or near-normal plasma glucose levels as an outpatient usually requires close attention and modification of treatment to deal with changing insulin requirements in the postoperative period.

Elsewhere in this issue, Gavin makes several important points that deserve clarification and emphasis. I will focus on two points that should have the greatest impact on the management of diabetes in patients having an operation in the 1990s: bedside blood glucose monitoring and intravenous insulin administration.

The desired range of metabolic control for preoperative diabetic patients is like a target with three rings. The outer ring of the target is the avoidance of both serious hypoglycemia and diabetic ketoacidosis. This can be accomplished in a variety of ways with little effort, keeping the plasma glucose level between approximately 2.8 and 22.2 mmol per liter (50 and 400 mg per dl). The second ring of the target is the broad range of plasma glucose—approximately 3.9 to 12.2 mmol per liter (70 to 220 mg per dl)—that is not associated with obvious signs or symptoms. To achieve this level of control requires a bit of effort but should be attainable in most patients and in most hospital settings. The bull's-eye of this target is normal or near-normal glucose levels—4.4 to 8.3 mmol per liter (80 to 150 mg per dl)—that may enhance wound healing and reduce the risk of infection by optimizing leukocyte function.

A major problem in convincing clinicians that meticulous control of plasma glucose levels is important for diabetic patients after an operation is that, other than missing the target altogether, neither clinicians nor patients are likely to ever appreciate the results of good control. Patients with poor glucose control often recover from an operation without obvious adverse effects. Patients with good glucose control (or even nondiabetics) may have poor wound healing or postoperative infection unrelated to their plasma glucose levels. Because there are so many variables, there will probably never be a definitive study that clearly shows the benefits of good glucose control for a diabetic patient after surgical treatment. There is sufficient circumstantial evidence, however, to warrant a goal of normal or near-normal glucose

levels in most if not all diabetic patients. This goal should be modified if attaining it is unsafe—the patient has serious hypoglycemia—or if the effort required to achieve it is greater than the potential benefits.

The most notable advance in diabetes management since the discovery of insulin has been the availability of methods that allow frequent blood glucose measurements with a rapid turnaround. The self-monitoring of blood glucose levels has permitted intensive therapy for ambulatory diabetic patients to achieve long-term normoglycemia to minimize the complications of diabetes. Self-testing of the blood glucose concentration is a prerequisite for tight glucose control. A number of glucose monitoring systems that provide satisfactory results are available. About ten years ago most diabetologists substituted patient self-monitoring of blood glucose levels for urine glucose testing in ambulatory patients. There is no question that bedside blood glucose monitoring can be useful in the hospital, allowing clinicians to detect trends and adjust treatment programs. Many hospitals have been slow to implement bedside blood glucose monitoring programs, however, for a variety of reasons that usually do not stand up to close examination. Bedside blood glucose testing should be instituted in all hospitals and should be available on most if not all hospital service areas, particularly where postoperative diabetic patients are cared for. The American Diabetes Association has provided guidelines, including training and quality control, that should be followed for the proper use of glucose meters in hospital.[1]

With the availability of techniques that permit more frequent monitoring of blood glucose concentrations came the realization that using the traditional approach of subcutaneously administering insulin to control blood glucose levels often hit only the outside ring of the glucose target. This led to the development of strategies for intravenous insulin administration. Insulin given intravenously has the advantage over subcutaneous insulin of allowing a more rapid responsiveness to changing insulin requirements. Not only can hyperglycemia be better controlled with intravenous insulin, but our experience shows that hypoglycemia is less common when insulin is given intravenously instead of subcutaneously.

About five years ago we began working on an algorithm for an "insulin drip" using simple adjustments in the insulin drip rate based on bedside blood glucose determinations every two hours.[2] Emory University Hospital had already instituted a program of bedside glucose monitoring. This approach, which works best with an infusion pump or a similar device to control the rate of insulin infusion, provides excellent glucose control in most patients postoperatively and is also useful for stabilizing poorly controlled patients before an operation. The algorithm is flexible and allows the insulin dose to be titrated for almost any circumstances. Although our algorithm is intended to work as an "automatic pilot," it includes provisions for physician notification if a patient's blood glucose level is not maintained in the target range. For patients undergoing a major operation who will require insulin coverage, we start the insulin drip on the morning of the surgical procedure if the patient has been in reasonable control or the night before if preoperative control has been poor or questionable. For most patients, preoperative control can be achieved and postoperative control can be maintained until the patient is ready to resume eating and go back on a regimen of subcutaneous insulin.

Our insulin drip system is simple and effective, and we have come to rely on it (or even take it for granted) in a variety of circumstances, such as for diabetic patients who have nausea and vomiting or are not taking fluids or solids by mouth for reasons other than surgery. There are, however, simpler strategies that can be used for administering insulin intravenously to stable diabetic patients where less rigid glucose control is acceptable. Simply adding a regular insulin injection to maintenance intravenous fluids with dextrose is likely to hit the second ring of the glucose target most of the time. For most patients, an insulin infusion rate of 1.0 to 2.0 units per hour is satisfactory. Of course, bedside blood glucose monitoring should be done every four to six hours and treatment modified as needed.

Some diabetic patients undergoing minor surgical procedures can be managed with subcutaneous insulin or no insulin at all. Type II diabetic patients who are well controlled with diet or oral hypoglycemic agents who are undergoing minor procedures and will be eating soon afterwards can be managed by avoiding glucose in their intravenous fluids and with blood glucose monitoring; subcutaneous or intravenous insulin can be added later if needed. Insulin-requiring patients whose diabetes is well controlled can be managed during a minor procedure that is scheduled early in the day by giving a fraction (⅓ to ½) of their usual insulin dose subcutaneously before surgery and a "sliding scale" of subcutaneous regular insulin injections every four to six hours afterwards as needed.

For optimal management of diabetic patients in hospital, bedside glucose monitoring should be available. Insulin treatment should be tailored to each patient. For minor procedures, insulin therapy can be withheld or given subcutaneously as a fraction of the usual dose. For major procedures in insulin-treated patients, intravenous insulin is preferred over subcutaneous insulin. A flexible insulin drip provides better glucose control than a fixed-rate insulin drip, but a simple, fixed-rate insulin drip—with insulin added to intravenous fluids with dextrose—can be used if infusion pumps or frequent blood glucose monitoring are not available. If possible, clinicians who have special interest and expertise should be called on to manage diabetic patients in the hospital for an operation or an intercurrent illness.[3] Whoever is called should be using these tools to achieve the best possible glucose control for their patients.

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Professional Values and Organized Medicine

THERE IS A GROWING CONCERN that organized medicine may not be attracting new members as well as it should, and this in spite of some intense efforts at recruitment by many medical associations. There is disturbing evidence that medical asso-